

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
21 March 2002 (21.03.2002)

PCT

(10) International Publication Number
WO 02/22961 A1

(51) International Patent Classification⁷: **E01F 8/00**

(21) International Application Number: **PCT/EP00/08988**

(22) International Filing Date:
13 September 2000 (13.09.2000)

(25) Filing Language: **English**

(26) Publication Language: **English**

(71) Applicant (for all designated States except US): **TERCA BRICKS N.V.** [BE/BE]; Ter Bede Business Center, B-8500 Kortrijk (BE).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **VAN REETH, Rudy** [BE/BE]; Pullaarsesteenweg 149, B-2870 Puurs (BE). **WAGENER, Fons** [NL/NL]; De Rosmolen 10, NL-6681 MA Bommel (NL).

(74) Agent: **LEHERTE, Georges**; K.O.B. n.v., Pres. Kennedypark 31C, B-8500 Kortrijk (BE).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

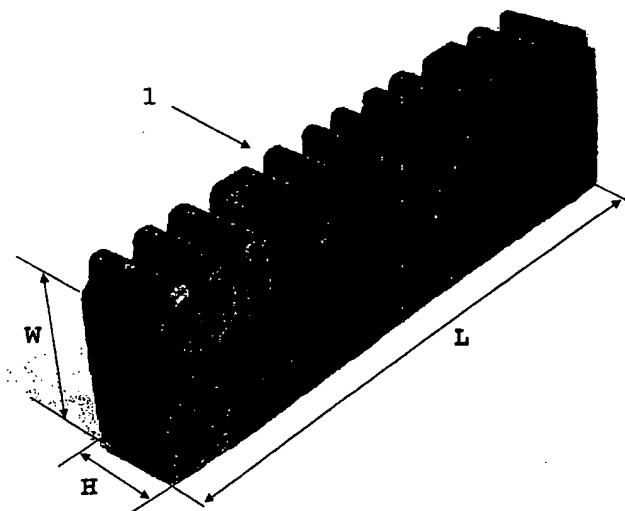
(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **ACOUSTIC CONSTRUCTION ELEMENT FOR SOUND INSULATION IN A BROAD RANGE OF FREQUENCIES**



(57) Abstract: The invention relates to an acoustic construction element comprising sound insulating cavities of which at least part have a first portion (4), which is situated closest to the external surface (3) of the element and at least a second portion (5) having a maximum internal width (6) which is larger than the smallest width of said first portion (4) of the cavity. At least some of said cavities have different internal volume, of which preferably the portion of the cavities beyond the first portion have a circular or oval shape. Said construction element further comprises preferably cavities (e, f, h) having a substantially constant width over their entire depth. The invention further relates to the use and the method of manufacturing said construction elements.

BEST AVAILABLE COPY

WO 02/22961 A1

ACOUSTIC CONSTRUCTION ELEMENT FOR SOUND INSULATION IN A
BROAD RANGE OF FREQUENCIES

The present invention relates to an acoustic construction
5 element comprising sound insulating cavities.

The use of the "mass" of a construction element and/or
perforations or cavities made in a construction element
to obtain sound-insulation is a common known principle.

10

In European patent application n° EP 0 580 096, for
example, there is described a sound-insulation element
having a wall, exhibiting perforations, and having a
cavity which receives a sound-absorbing packing, which
15 covers the mouths of the perforations. The perforation-
containing wall is formed by a plurality (at least two)
of acoustic bricks which are fastened one beside the
other on a cross-sectionally U-shaped shell. The
acoustic bricks usually consist of ceramic material.

20

In French patent application n° FR 2612225, there is
revealed an acoustic lining element, made of burnt clay,
ceramic materials, cement, wood, plaster or the like.
This acoustic lining element comprises a plane
25 rectangular face intended to be attached to a wall. The
opposite face to this one comprises a network of ribs
forming corrugations parallel to one of the sides.

The disadvantage of these acoustic construction elements
30 is that they preferably need an addition of sound-

insulating material to obtain the desired sound-absorbing properties.

To become sufficient sound-insulation without the need of
5 supplementary sound absorbing material, Japanese patent
application n° JP 09328833 describes a sound-absorbing
block by baking fire clay, into which a pore imparting
material is mixed, and fire-resisting chamotte. In the
ceramic block, there are bored holes of different depth,
10 drilled all over at right angles to the thickness
direction. The ceramic block is reported to have sound
absorbing performance in a frequency band having broad
width.

15 The problem with this state of the art technique is that
there still are sound frequencies that are not absorbed
and thus can lead to noise pollution or disturbing noise.

The object of this invention is to provide in a sound-
20 insulating construction element that can absorb a broad
range of sound frequencies and that can be manufactured
depending on the type or the frequency of noise pressure.
For instance, the frequency of the disturbing noise that
results from a truck that drives on a highway differs
25 from the noise that has to be absorbed when one records a
song in a music studio.

This object is achieved by an acoustic construction
element comprising sound insulating cavities, but in
30 which at least part of the cavities have a first portion
(in particular the access part to the cavity), which is

situated closest to the external surface of the element and at least a second portion having a maximal internal width which is larger than the smallest width of said first portion of the cavity.

5

In a preferred embodiment, at least some of said cavities have different internal volumes. This makes it possible to absorb a wide range of different sound frequencies.

- 10 A further characteristic of the invention is that the cavities have a constant shape along an axis parallel to the exposed surface of the construction element in use.

The cavities can have different shapes.

15

In a first embodiment of the invention, the portion of the cavities beyond the first portion is circular or oval in shape.

- 20 In an other preferred embodiment, said construction element further comprises cavities having a substantially constant width over their entire depth.

Preferably, at least some of said further cavities have
25 different internal depths.

The construction element can be manufactured out of different materials. Preferably, said construction element is made of ceramic material. In this way,
30 ceramic construction elements can be used as regular building bricks.

An advantage not to neglect is that the construction element according to the invention can be used as a load carrying construction element.

- 5 The method for manufacturing acoustic construction elements is preferably by way of extrusion of the ceramic materials.

Further distinctive features and characteristics will be
10 clarified in the following description of a specific embodiment of the invention as represented in the attached drawings. It should be noted that this embodiment is only given by way of example and implies no restriction in the general scope of the invention as that
15 appears from the above description and from the claims at the end of this text.

In the attached drawings:

- **figure 1** is a perspective side and front view of an
20 acoustic construction element according to the invention;
- **figure 2** is a side view of an acoustic construction element as shown in *figure 1*.

25 As shown in figure 1, the acoustic construction element is an acoustic brick (1) with a length (L) of 324 cm, a height (H) of 5 cm and a width (W) of 10 cm. The brick is manufactured by extrusion of ceramic material, more specific red-baking clay. The acoustic brick has a
30 smooth surface. By using other clays or by addition of aggregates to the base material, the brick can obtain a

different color or even a sandy structure . The surface can also be rough. In function of the composition, characteristics as the absorption of water, the intensity of the pressure,... can differ.

5

As shown at figure 2, the acoustic brick comprises at irregular distances, varying between 1 and 4 centimeter, separate entries of cavities (4). At least part of said cavities have a first portion (4), which is situated
10 closest to the external surface of the element and at least a second portion (5) having a maximum internal width (6) which is larger than the smallest access to the cavity. In the example, the cavities are each characterised by an elongated (of type e, f or h) or a
15 "circular" (of type g, i) cavity with a different width, depth or circular shape. Herewith, an aimed distribution of different sound-absorbing and/or reflection-rooms is achieved, through which sound with varying frequencies can be muffled and absorbed.

20

Typical of the elongated cavities are the width of the cavity (w_e) and the depth (d_e) in the ceramic mass. Typical of the circular cavities are the width of the access or entry at the top of the cavity (w_c), but
25 especially the radius (r_c) and the depth (d_c) of the centre (x) of the circle. Instead of a circular shaped cavity, the cavity can also be oval shaped (cfr. cavity type i).

30 The brick has thus a two-fold function: for one, the ceramic mass takes care for the absorption of the sound,

and for another, the cavities are dimensioned in such a way that by the way of internal reflection, the sound doesn't get the chance to be reflected into free space. In this way, the width (W) of the stone and the width
5 (w_c, w_e), the depth (d_c, d_e), the radius (r_c) of the cavities and their position on the stone can be adapted in function of certain types of frequencies and/or the level of the sound that has to be adsorbed. Once the character is known of the disturbing sound, the perforation pattern
10 and the width of the stone can be laid down.

It is a purpose that said perforation pattern is repetitive. That's why the upper ends (2) are rounded off, with the purpose that the joining creates a new cavity.

15

The cavities have a constant shape along an axis parallel to the exposed surface of the acoustic brick in use (= along the height (H) of the acoustic brick).

20 The acoustic construction element according to the invention can be used on every place where noise or noise pollution is an item, for instance in:

- laboratory
- hospitals
- 25 - industry:
 - * as an inside or outside wall of factories, offices,
...
 - * around compressors, motors, machines and computer rooms
- 30 - concert halls, theatres, disco's, exposition halls, cinema rooms, hotel and catering industry, ...

- along motorways, highways, train sections, stations, airports, ...
- as a partition wall in apartment buildings and office buildings: around elevator shafts, engine rooms, ...
- 5 - municipal buildings: libraries, sport halls, cultural centers,
- schools and universities
- agriculture and cattle breeding: pig farms, chicken coops, ...

10

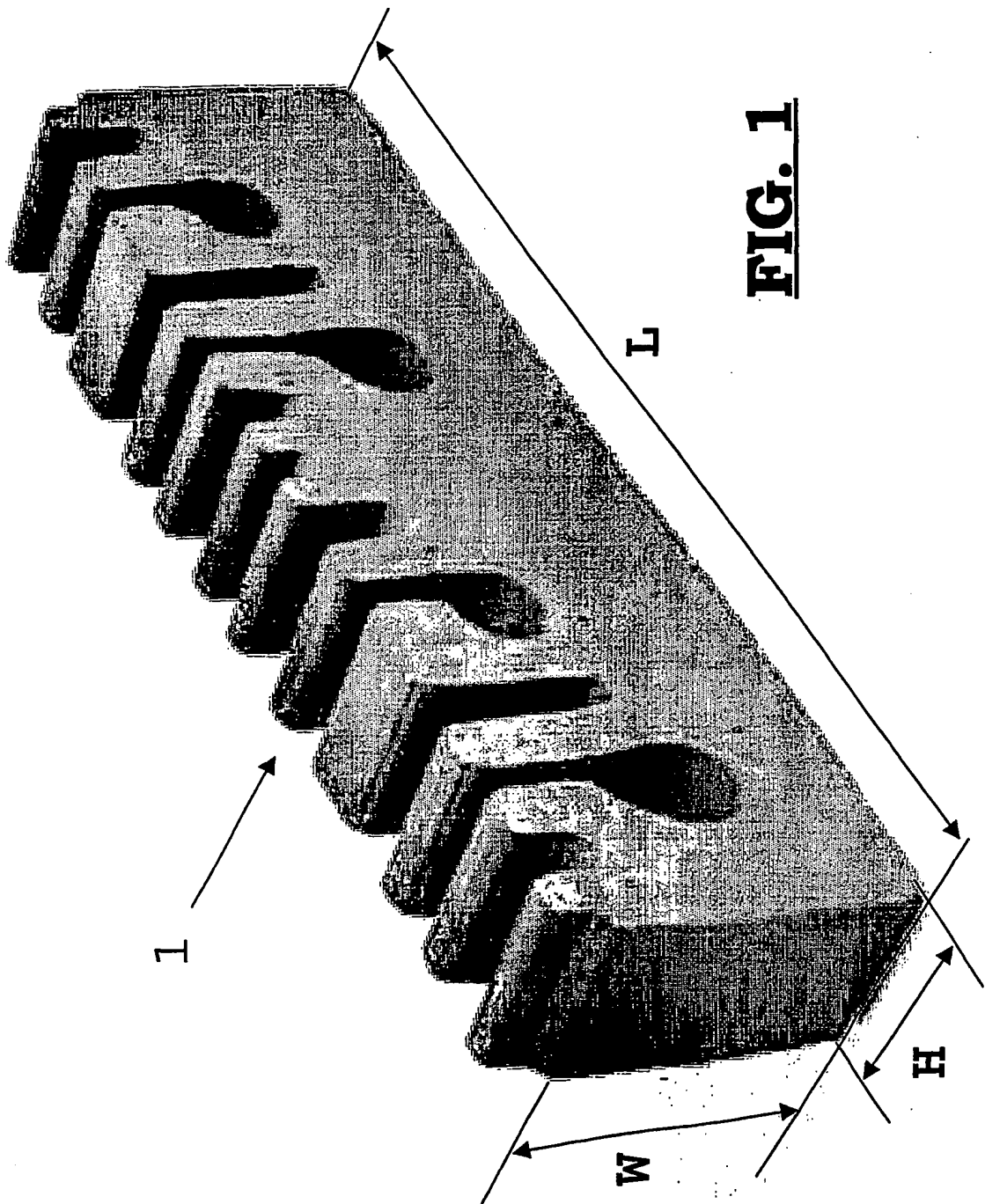
In certain applications, the cavities can also serve as a carrier of technical pipes for for instance electricity, computers, telephone, sanitary, heating, ...

- 15 The bricks or the panels can be mounted either horizontally, either vertically, or in a combination of the two, can be glued together or layed in bricks, or can function as a carrying or non-carrying part. For example, the bricks can be used as road blocks on which
- 20 traffic can circulate. The disturbing frequencies that arise when car tyres roll over the road surface can be absorbed by using the acoustic bricks as horizontal carrying driving surfaces. The cavities that are present in the bricks could also function for draining the excess
- 25 of water when it's raining.

C L A I M S

1. Acoustic construction element comprising sound
5 insulating cavities characterised in that at least
part of said cavities have a first portion (4), which
is situated closest to the external surface (3) of
the element and at least a second portion (5) having
a maximum internal width (6) which is larger than the
10 smallest width of said first portion (4) of the
cavity.
2. Acoustic construction element according to claim 1
characterised in that at least some of said cavities
15 have different internal volumes.
3. Acoustic construction element according to claim 1 or
2 characterised in that the cavities have a constant
shape along an axis parallel to the exposed surface
20 of the construction element in use.
4. Acoustic construction element according to one of
claims 1 to 3 characterised in that the portion of
the cavities beyond the first portion is circular or
25 oval in shape.
5. Acoustic construction element according to any one of
claims 1 to 4 characterised in that said construction
element further comprises cavities (e, f, h) having a
30 substantially constant width over their entire depth.

6. Acoustic construction element according to claim 5 characterised in that at least some of said further cavities (e, f, h) have different internal depths.
- 5 7. Acoustic construction element according to any one of claims 1 to 6 characterised in that said construction element is made of ceramic material.
8. Use of an acoustic construction element as a load
10 carrying construction element.
9. Use of an acoustic construction element according to claim 8 characterised in that a construction element according to any one of claims 1 to 6 is used.
15
10. Method for manufacturing acoustic construction elements characterised in that the shape of said construction elements results from the extrusion of ceramic material.
20
11. Method according to claim 10 characterised in that cavities are extruded according to any one of claims 1 to 6.



BEST AVAILABLE COPY

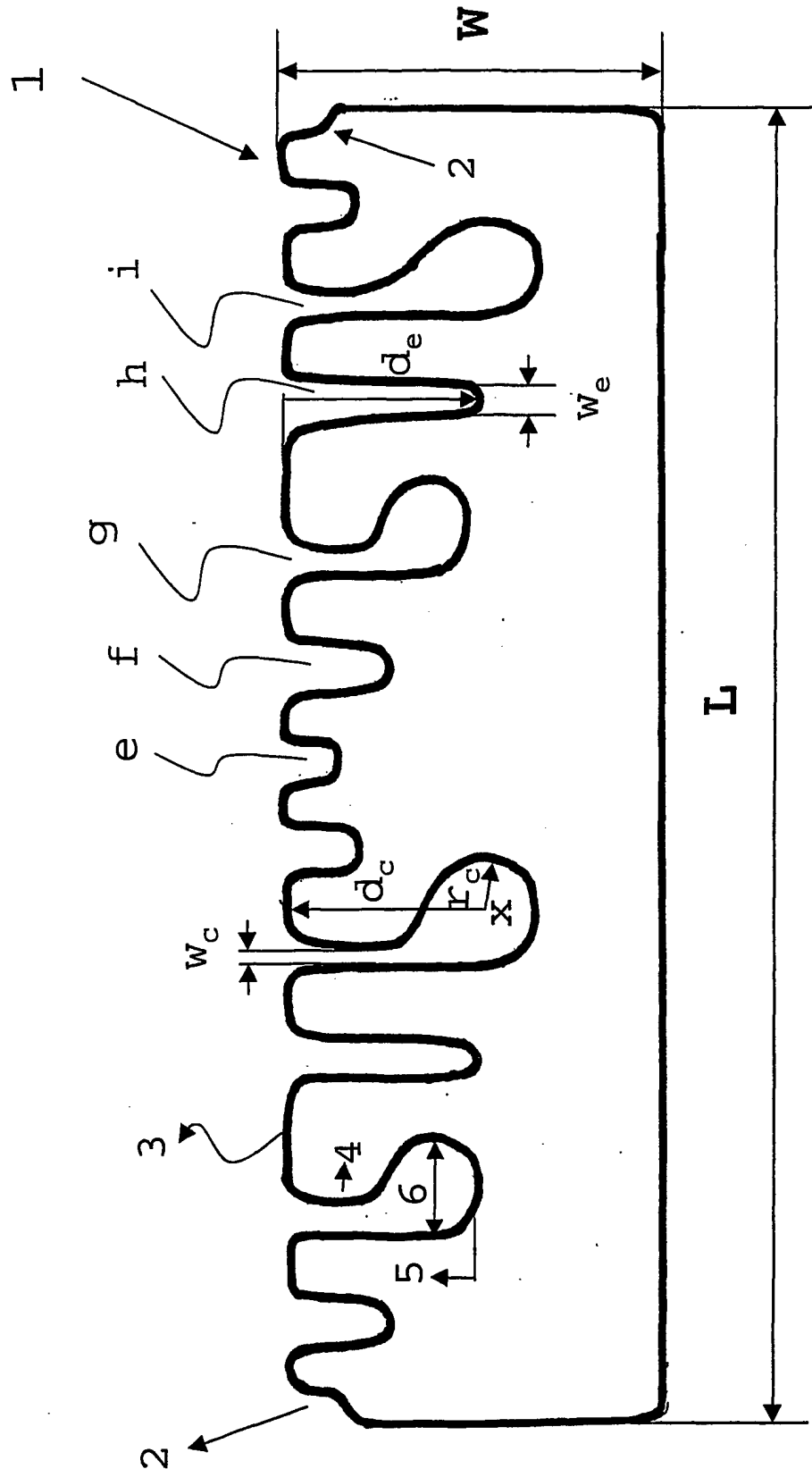


FIG. 2

INTERNATIONAL SEARCH REPORT

onal Application No

CT/EP 00/08988

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E01F8/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 746 831 A (IOSEPH PERASSO) 3 October 1997 (1997-10-03) page 4, line 18 -page 6; claims; figures	1-5, 8, 9
X A	DE 198 23 139 A (LECH) 14 October 1999 (1999-10-14) column 7, line 10 -column 8, line 65; figures 1-34	1-3, 5, 7-11 4, 6
X	DE 33 22 189 A (SF-VOLLVERBUNDSTEIN-KOOPERATION) 10 January 1985 (1985-01-10) page 11, line 6 -page 16; figures	1, 2, 7-9
X	FR 2 742 178 A (PROMO BREVET BORG) 13 June 1997 (1997-06-13) page 7, line 25 -page 11; figures	1, 3, 4, 8, 9

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the International filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the International filing date but later than the priority date claimed

- *T* later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- *G* document member of the same patent family

Date of the actual completion of the International search

7 May 2001

Date of mailing of the International search report

15/05/2001

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Vijverman, W

BEST AVAILABLE COPY

INTERNATIONAL SEARCH REPORT

Information on patent family members

onal Application No

T/EP 00/08988

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
FR 2746831	A	03-10-1997	NONE	
DE 19823139	A	14-10-1999	NONE	
DE 3322189	A	10-01-1985	NONE	
FR 2742178	A	13-06-1997	NONE	